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THE STRATEGIC VALUE OF LEVERAGE: AN EXPLORATORY STUDY

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The Strategic Value of Leverage: Empirical Evidence

Abstract

This paper explores the strategic role of debt in product markets by relating cross-sectional differences in inter- and intra-industry leverage ratios to proxies for the potential for collusion and entry in 199 industries in 1989. Inter-industry regressions show little overall relation between measures of structure, contestability and leverage. Moreover, there is little evidence that the intra-industry determinants of leverage differ when the potential for strategic interaction is high. This leaves little empirical basis for broadly applicable, theoretical models where leverage policy can interact with a firm's financial condition in oligopolistic industries.

1. Introduction

A rich theoretical literature suggests that corporate capital structure choice may be influenced by the potential for collusion and predatory behavior within an industry. For example, Brander and Lewis (1986) show that a unilateral increase in leverage tilts management incentives toward expansion, resulting in higher profits and an expanded market share. In contrast, Fudenberg and Tirole (1985) and Bolton and Scharfstein (1990) show that leverage disadvantages firms by exposing them to the risk of predation by more liquid and less levered rivals. In reviews of this literature, Ravid (1988) and Harris and Raviv (1991) point out that while the strategic benefits of debt in product markets may be important in capital structure decisions, little empirical work has been carried out in this area.

In this paper we investigate whether cross-sectional variation in firm's capital structures is related to the potential for oligopolistic collusion and rivalrous predation. While motivated by the theoretical literature, our analysis is exploratory in nature. We do not test specific structural implications of existing, stylized models of the interaction

between product market factors and capital structure. Rather, the main question we ask is whether measures of industry structure (i.e. concentration ratios and the number of firms in an industry) and contestability (i.e. historical entry rates and minimum efficient scale) can explain a significant proportion of the observed cross-sectional variation in firm's capital structures. Our goal is to find whether significant empirical regularities relating capital structure to strategic factors exist. After introducing a set of "traditional" control factors which are known to be related to leverage, we test whether strategic factors in the product market have additional power to explain inter- and intra-industry differentials in firm's use of short-term, long-term and convertible debt. Given the exploratory nature of our inquiry, we analyze some effects that have not been examined by existing theories. In this way we hope to point to areas where current and future research efforts may explain important patterns in the data.

To our surprise, the results are largely negative. We find no evidence that differences in industry leverage ratios are related to measures of competitive conditions within an industry. At best, strategic factors can account for only two percent of the cross-sectional variation in inter-industry leverage ratios. Moreover, we do not find that the traditional cross-sectional determinants of leverage across and within industries are influenced by industry structure as is implied by several models.

Our results contrast with those of Phillips (1992a) and Spence (1985) who find evidence of a strategic role for leverage in product markets. Phillips (1992a) finds that increases in debt appear to have reduced price competition in three concentrated industries that also have high entry barriers. Phillips' study differs from ours in that it

is dynamic in nature and uses information on prices and quantities of goods sold. He also restricts his analysis to industries which have seen leveraged recapitalizations and leveraged buyouts by the largest incumbents. Because we do not require price and quantity data we are able to study a much larger group of industries. Our failure to find a cross-sectional relation between leverage and strategic factors could be consistent with Phillips' results if the strategic effects of leverage are transitory or limited to industries which have seen dramatic changes in incumbent's capital structures. Spence (1985) finds that firms in concentrated industries tend to have less leverage than other firms. His regressions include data on 940 firms in the 1970-74 period. It is more difficult to account for the difference between our results and those of Spence. The larger number of controls used in this study and differences in specifications may explain some of the difference.[1] In any case, Spence's results do not assign a large empirical role to product market factors.

The remainder of the paper proceeds as follows. In Section 2 we lay out the study design and identify empirical proxies for the potential for strategic product market interaction. In Section 3 we provide our empirical results. In Section 4 we discuss the implications of the results for existing models and conclude with some suggestions for future research.

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[1]Unreported analyses structured similar to those in Spence (1985) did not show a statistically significant, negative effect of industry concentration on leverage.

2. Study Design

The empirical implications of models of the strategic role of leverage in product markets can be broadly classified by whether they involve cross-sectional differences in financial policy across industries or within industries. Some models imply that certain types of industries will have higher average leverage while others suggest that certain types of firms inside an industry will have lower (or higher) leverage relative to their rivals because of strategic factors. Thus, we estimate inter- and intra-industry leverage regressions to separately explore these mechanisms in which strategic factors affect firm's financial decisions. These regressions include proxies for both "traditional" determinants of capital structure and proxies for strategic determinants of capital structure. We use variable addition tests to determine whether regressions including strategic proxies have greater explanatory power than regressions based on traditional factors only. The set of traditional factors is virtually the same as that employed by Titman and Wessels (1988).[2]

2.1 Inter-industry Effects

Product market-capital structure models can be classified into "debt makes you tough" and "debt makes you weak" categories. Brander and Lewis (1986) and Maksimovic

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[2]There are several differences in our variable set and that of Titman and Wessels (1988). First, we do not include employee quit rates because they are no longer published. Second, we do not relate firm's investment tax credits to leverage because the Tax Reform Act of 1986 repealed the Investment Tax Credit (ITC) and our sample is from 1989. Third, we use only one measure of profitability. Fourth, because the median ratio on intangibles to assets within an industry is almost always zero, we do not include this variable in inter-industry regressions.

(1988) are examples of the first category while Fudenberg and Tirole (1985), Bolton and Scharfstein (1990), Phillips (1992b) and Guedes (1991) are examples of the second.

In "debt makes you tough" models, oligopolistic sellers behave aggressively, usually in a Cournot competition game, by taking on debt.[3] In a non-collusive equilibrium as in Brander and Lewis (1986) firms in the industry raise mutually destructive amounts of debt leading to increased output and depressed prices. In a collusive equilibrium as in Maksimovic (1988) firms limit the amount they borrow in order to restrain themselves from pursuing expansionary policies. The level of leverage in oligopolistic industries thus depends on the particular type of equilibria that emerges. For example, leverage should be lower in industries where collusion is easier to sustain. In a cross-sectional sample of high strategic interaction industries, however, average industry profitability and leverage should be inversely related if observations are drawn from both equilibrium outcomes. These predictions are reversed in "debt makes you weak" type of models such as Guedes (1991) and Phillips (1992b). Here, management uses discretionary resources to invest in new capacity and advertising. Debt limits available discretionary resources and thus weakens the firm's position in the product market. Moreover, in a cross-sectional sample of industries with high potential for strategic interaction, average industry leverage should be positively related to profitability and negatively related to measures of investment effort.

In other models such as Fudenberg and Tirole (1985) and Bolton and Scharfstein

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[3]This conclusion is sensitive to the type of competition assumed. John and Sundaram (1992) find the opposite result when Bertrand price competition occurs in an industry.

(1990) debt makes the firm weak because it makes it vulnerable to predation. These "long-purse" models suggest that firms in industries where rivals can exercise market power will have less debt. Also, in these models debt makes the firm weak because asymmetric information between management and lenders leads to refunding difficulties when profits are low. Since the risk of encountering refunding difficulties is most severe for firms with asymmetric information problems, those firms will rationally assume less debt in the first place. Thus, proxies for asymmetric information (e.g. R&D intensity in the industry and size) should have a stronger negative effect on leverage in industries where firms' possess market power.

We examine several measures of the degree of strategic interaction in an industry. One measure is the number of firms in the industry. [See Bresnahan and Reiss (1992)]. A more traditional measure of market power is the Four-firm concentration ratio and the Herfindahl index of industry concentration. The Department of Justice, for example, bases much of its analysis of the anti-competitive effects of mergers on concentration ratios. At low levels of concentration, the ability of the firm to influence its competitors' behavior is likely to be negligible, giving leverage no strategic value.[4]

The sustainability of collusion is also likely to depend heavily on the contestability of an industry by entrants [e.g. Baumol (1983)]. The Department of Justice also looks at contestability when scrutinizing mergers. Unfortunately, it is not easy to measure the

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[4]It would be misleading to suggest that the potential collusive behavior can readily be identified by selecting industries with concentration ratios above some critical threshold. Nonetheless, several studies suggest that collusive behavior is most prevalent in industries with Four-firm concentration ratios in excess of 50 percent. [See Geithman, Marvel and Weiss (1981)].

potential for entry into an industry. One factor which may raise the cost of entry is the minimum investment needed to achieve efficient scale economies. A widely used measure of minimum efficient scale is the average plant size within an industry [e.g. Strickland and Weiss (1976)]. An alternative measure of contestability is the historical rate of entry into an industry. It is possible, of course, that industries with low historical rates of entry still experience little collusion because of pressure from potential entrants [see Panzar and Willig (1977)]. However, it is unlikely that industries with high actual historical entry have greater costs of entry than those with low entry rates. Thus, we use a dummy variable for industries with low historical rates of entry as a crude proxy for contestability.

We use these measures of industry structure and contestability to test for inter-industry strategic effects in two ways. First, we examine their explanatory power when used as additional independent factors over and above the Titman and Wessels (1988) control variables. Second, we examine their influence by interacting the Titman and Wessels controls with a dummy variable which takes the value one for high strategic interaction industries and zero otherwise. From our previous discussion we know that some of these interaction variables such as those based on profitability and investment effort can be motivated by existing theoretical models. Others, however, have not been the subject of prior theoretical work. Thus, our empirical analysis may point to some promising areas (and also some dead ends) for future theoretical work examining the role of financial policy in product markets.

2.2 Intra-industry Effects

"Debt makes you tough" and "debt makes you weak" models have opposing implications about financial policies in industries where members enjoy market power. The former suggest that profits, investment, and market shares are higher for firms that borrow more extensively; the latter suggest the reverse.

As in the inter-industry case, we explore the possibility that traditional variables have a differential impact on leverage in concentrated and unconcentrated industries. The intra-industry regressions use deviations from the medians of both the dependent and independent variables in order to examine the determinants of leverage differentials within an industry. The possibility that the intra-industry determinants of leverage differ in concentrated industries is explored by interacting an industry concentration dummy with the Titman and Wessels (1988) control variables.

2.3 Measures of Leverage

We examine three measures of leverage in this study: long-term debt/total assets, short-term debt/total assets and convertible debt/total assets. Assets are measured at book value. This is important in the context of this study since it is well known that firms with market power tend to have higher equity values and hence lower debt/assets at market than other firms [Smirlock, Gilligan and Marshall (1984)].

We distinguish the determinants of long-term versus short-term debt because short-term debt is likely to lead to more refunding difficulties in the event of poor performance which increases firms vulnerability to predation by rivals. We also

conjecture that strategic factors may influence firm's use of convertible debt. For example, the asset substitution problem which drives the Brander and Lewis (1986) results can be substantially ameliorated with convertible debt. Thus, collusion and aggregate industry profitability can be enhanced by the use of convertible debt. In contrast, within concentrated industries, heavy users of convertible debt should have lower relative profits and market shares. In addition, convertible debt may give rivals an additional incentive to place financial pressure on a firm. For example, rivals may lower prices in order to keep equity prices below the conversion level to maintain high financial pressure on a firm.

2.4 Sample Selection and Data Sources

We analyze the capital structures of 3,369 U.S. firms in 1989. All of these firms had publicly traded equity since we obtained data on firm financial characteristics from the COMPUSTAT II PST, Full Coverage and Research files. Cases where one of the variables required for our analysis was missing were deleted. Our data source for information on industry characteristics is the 1989 Economic Information Systems TRINET database. This database contains information on over 700,000 business plants and offices (establishments) in the United States and is constructed by thousands of phone calls each year, reviews of company documents and access to FTC business establishment records. The coverage of the database is quite comprehensive, with information on more than 97 percent of large public firms and on more than 80 percent of small firms with less than 100 employees. Unlike the Industrial Census data on

industry concentration, this data source has information which allows to define industry structure in all enterprise sectors of the econony. Because each record has a parent code, an industry code, and an estimate of establishment employment the TRINET data is ideal for measurement of variables such as market share, industry concentration and industry entry rates.

The industry four-firm concentration ratio is defined as the fraction of employees within a 3-digit SIC code in the largest four firms. Industries with low entry rates had a change in number of firms of not more than 10 percent and not less than -10 percent between 1981 and 1989. Minimum efficient scale is defined as the median establishment size within a 3-digit SIC industry.

3. Empirical Results

3.1 Sample Description

Table 1 shows the distribution of the variables examined in this study. The firms in the sample have a median long-term debt/asset ratio of 20%. The median short-term debt/assets ratio is considerably less at 5%. Less than a fourth of the firms have any convertible debt at all.

Table 1 shows considerable inter-industry variation in measures of the potential for strategic product market interaction. For example, most of the 199 3-digit SIC industries represented in our sample have low industrial concentration: the median four-firm concentration ratio is 25%. Similarly the number of firms in most industries in the sample is quite large. The median industry has more than 200 firms.

The Titman and Wessels (1988) set of control variables also exhibits high cross-sectional variability. The interquartile range of the log of sales is 2.88 to 6.22 (or $17.8 to $502 million). Thus, most firms in our sample could best be characterized as small to moderate. This reflects the large number of firms drawn from the COMPUSTAT Full Coverage tape.[5] Also notable is the fact that at least 25% of the firms report negative operating earnings and a negative asset growth rate over the 1987-89 period.

While our analysis asks whether there is a statistical association between measures of leverage and industry structure, much can be learned by examining extreme cases in the sample. Table 2 shows the industry median of the long-term and short-term debt/assets ratio in the twelve 3-digit SIC industries with the greatest and the least industry concentration in 1989. Among highly concentrated industries we see four cases with a long-term debt/assets ratio less than the sample median of 20% and eight cases above this median. Most notably, there are only two industries (federal credit agencies and cinemas) where the median long-term debt/assets ratio is more than 10 percentage points away from the median. We also find that 9 of the 12 least concentrated industries have leverage within 10% percentage points of the sample median. Thus, it would be fair to characterize most firms in industries with extremely high or extremely low concentration as has having leverage positions similar to the average firm in the sample. This simple analysis leads us to doubt that strategic factors in product markets have a strong impact on firm's financial decisions.

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[5]Titman and Wessels (1988) did not use these firms in their study. Thus, we are studying firms which tend to be smaller than those looked at in most past studies.

3.2 Inter-industry Determinants of Leverage

Table 3 shows regressions predicting industry median leverage ratios using the medians of Titman and Wessels (1988) control variables.[6] There are five important results in this table. First, given that the adjusted R^2 in the regression predicting long-term debt/assets is 27%, the traditional controls work reasonably well in explaining cross-industry patterns of long-term borrowing. However, these controls perform poorly in explaining variation in short-term borrowing and convertible debt. Second, the ratio of plant & equipment to total assets is positively associated with long-term leverage but negatively related to short-term debt. This suggests that maturity matching of assets and liabilities goes on at the industry level. Third, as in Titman and Wessels (1988), R&D expenses, selling expenses, and the equipment industry dummy have an important influence on the use of long-term debt. Fourth, cash and operating profits are negatively and statistically significantly related to the amount of long and short-term debt. This is consistent with the pecking order hypothesis that firms prefer internal funds to borrowed funds. An alternative interpretation is that firms in industries facing downsizing or adversity, which are therefore low on cash and experience operating losses, tend to be more highly levered simply because they cannot increment retained earnings. Fifth, none of the controls is found to have a significant effect on the amount of convertible debt.

Table 4 reports regressions which add proxies for the potential for strategic

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[6]We reduce the influence of outliers by excluding industries with median long-term debt to assets ratios more than three standard deviations from the sample median.

product market interaction to the previous equations. Inspection of the increment in the adjusted R-squares of these models shows that the strategic proxies add little explanatory power to traditional accounts of inter-industry leverage patterns. Model specification tests reject the model with strategic variables in favor of the parsimonious model with only the traditional controls for all the three debt types. Looking at individual coefficients the only significant result is a positive coefficient for the low entry dummy in the short-term debt regression. An interpretation of this finding is that, compared to incumbents, entrants come in with less short-term debt because they face more severe asymmetric information problems and thus are more vulnerable to predation (since they are more exposed to refinancing difficulties in the case of poor performance). Alternatively, this coefficient may have been statistically significant by chance.

Measures of industry structure and contestability also contribute little to models explaining inter-industry leverage in Table 5. This table shows regressions predicting leverage ratios using the first six principal components from the Titman and Wessels (1988) variables. This approach allows us to collapse the large number of controls into a small number of orthogonalized factors and mitigate collinearity problems which are endemic in regressions using structurally inter-related income statement and balance sheet factors to predict leverage. The potential benefit of this approach is an increase in the precision of the coefficient estimates for the strategic variables; the cost is a small loss in explanatory power. The results, however, are qualitatively the same as those in

Table 4.[7]

Table 6 interacts the Titman and Wessels' controls with a dummy which takes the value one in highly concentrated industries. These industries are defined to have four-firm concentration ratio exceeding 50% no firm with more than 70% market share.[8] As discussed earlier, interaction variables for profitability, investment effort and proxies for information asymmetry can be motivated by theories which discuss the role of leverage on firm's competitive position within industries [e.g. Bolton and Scharfstein (1990), Fudenberg and Tirole (1986), Guedes (1991), and Phillips (1992b)]. Theory suggests that in a cross-section of concentrated industries, there should be a monotonic relation between leverage, on one hand, and profitability and investment effort on the other. Since this effect is over and above any impact that profitability and investment may have on leverage in unconcentrated industries, we should find different coefficients for profitability and investment proxies in concentrated industries.

The effect of adding the interaction variables is negligible for long-term debt and convertible debt but significant for short-term debt (the adjusted R^2 increases by 7%). For short-term debt we find a significant positive incremental effect of industry concentration on selling expenses/sales and investment/assets which may suggest a

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[7]Arguably, the absence of significant strategic effects is due to the large number of small firms in our sample. Perhaps the empirical importance of strategic variables is masked when there is a substantial fringe of small firms lacking market power in a concentrated industry. To address this issue we replicated Tables 4 and 5 using data on the largest four firms in each industry only. However, the qualitative character of the results did not change.

[8]We impose the market share threshold to exclude monopolistic industries where debt may play less of a strategic role.

strategic role for short-term debt in funding expansionary investments. The lack of a negative incremental effect on profitability, however, casts doubt on a strategic interpretation. There is also a significant negative incremental effect for the book value of plant, property and equipment divided by total assets which is difficult to rationalize using existing models.[9]

3.3 Intra-industry Determinants of Leverage

Tables 7 and 8 present regressions which analyze the intra-industry determinants of leverage. Table 7 contains only the Titman and Wessels' (1988) regressors while Table 8 also interacts those regressors with a dummy for high industry concentration. All variables are measured as deviations from industry medians. As in the inter-industry case we excluded all outliers with long-term debt/assets ratios outside a range of plus or minus three standard deviations around zero.

An surprising result in Table 7 is that the traditional controls do better in accounting for intra-industry patterns of short-term borrowing than of long-term borrowing (the adjusted-R^2 are, respectively, 16% and 9%). This contrasts with the earlier inter-industry results where the controls performed better in predicting long-term debt (the adjusted-R^2 are, respectively, 9% and 27%). In addition, pecking order behavior appears to be stronger within than across industries. The coefficients on

[9]To check for robustness we replicated Table 6 for different definitions of the dummy for high concentration. Specifically, using a Four-firm concentration ratio of 37% (sample 75th percentile) and 58% (sample 95th percentile) produced no material change in the results.

operating profits and cash/assets are negative and highly significant in both the long and short-term debt regressions. Some variables which were found to be important by Titman and Wessels are also statistically significant. This is true of the logarithm of sales, R&D expenditures/sales, intangibles/assets and selling expenses/sales. In addition, non-debt tax shields relative to assets is strongly negatively to leverage, suggesting that firms substitute these shields and debt. The importance of this variable in 1989 relative to earlier years is consistent with evidence in Givoly et. al. (1992) that firms responded to changes in tax incentives for debt following the 1986 Tax Reform Act.

Table 8 shows that the increase in explanatory power from interacting the Titman and Wessels' controls with a concentration dummy is quite small. The adjusted R^2 increases by only 1% in the long-term debt regression and is unchanged in both the short-term and convertible debt regressions. An F-test rejects the hypothesis that the controls affect leverage differently in concentrated and unconcentrated industries.

On an individual basis, however, some of the controls appear to play a different role in concentrated industries. For example, within concentrated industries, selling expenses/sales is strongly positively associated with long-term and convertible debt ratios and negatively with short-term debt ratios. A "strategic" interpretation for this finding is that firms with market power commit to an expansionary policy in the product market by taking on more long-term and convertible debt while lowering their short-term borrowings. Further evidence consistent with this interpretation comes from the estimates of the incremental effect of concentration on the coefficients of operating income/assets and cash/assets. The parameter estimates show that within concentrated

industries pecking order behavior is weaker with long-term debt but stronger with short-term debt. This pattern may reflect the role of long-term debt in making a firm a tough competitor in the product market. At the same time, the results for short-term debt may reflect firm's vulnerability to predation when pressured with immediate debt payments. If that is true, firms are more reluctant to use financial slack and operating profits to reduce long-term debt since that undermines their competitive position in the product market; they are also more willing to use internal funds to lower their short-term borrowings since that reduces their vulnerability to predation by rivals.

However, there are some problems with this interpretation. First, the positive empirical association between firm size and the amount of long-term borrowing is weakened within unconcentrated industries. Second, the strong negative relationship between the short-term debt ratio and size that we find within unconcentrated industries goes away in concentrated industries. Third, the estimates of the incremental effect of concentration on the coefficients for investment/assets and asset growth do not indicate that growth is associated with higher long-term and lower short-term debt ratios within highly concentrated industries. Thus, the results are suggestive at best. On the whole, it is difficult to argue persuasively for a strategic role for leverage based on the results contained in Table 8.[10]

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[10]The results in Table 8 were subjected to several sensitivity checks. We changed the concentration dummy to a Four-firm concentration ratio of 37% (sample 75th percentile) and 58% (sample 95th percentile). We measured variables by their within-industry ranks (instead of differences from their industry medians) and examined the incremental effects of concentration on rank regressions. Finally, we reestimated Table 8 using only the four largest firms in each industry. In every case we found no material change in the results.

4. Conclusion

There has been an upsurge of theoretical interest in the strategic role of debt in product markets in recent years but little accompanying empirical work. We have attempted to close the gap in the literature by undertaking an exploratory analysis of the importance of strategic factors in firm's leverage choices. We examined the role of strategic factors in explaining inter-industry leverage ratios and investigated whether "traditional" determinants of leverage play a different role within highly concentrated industries as predicted by several existing models.

On the whole, there appears to be little ground on which to argue that strategic factors in product markets play an important role in firm's financial decisions. Proxies for the potential for collusion have little power to explain cross-sectional variation in leverage ratios over and above that accounted for by traditional determinants of leverage. In the best case, we found that strategic interaction proxies increased the explanatory power of regressions predicting inter-industry leverage by only two percent. Similar interactions in intra-industry regressions also add little explanatory power. At best, our results give limited evidence that debt ratios are related to the scope for strategic interaction in the product market. The findings, even then, are difficult to explain with existing theories of the role of debt in product markets.

While our results do not suggest a large role for models which account for capital structure using strategic factors, it would be premature to rule such models out altogether. For one, we have not tested specific structural implications of these models. Nor can we ensure that the industries which are modeled have the properties of those

in our sample. This problem, of course, is widespread in the industrial organization literature. Alternative approaches within the framework of the "new" empirical industrial organization [Bresnahan and Schmalensee (1987)] call for dynamic analyses of only a few industries at a time [e.g. Phillips (1992a)]. This limits the generalizabilty of any conclusions drawn. Future empirical research might undertake further dynamic analyses such as those in Phillips (1992a) in a broader range of industries. It would also be interesting to examine firm's price and quantity responses in situtations where firm's leverage changes endogenously as the result of recapitalizations and repurchases and in situations where players exogenously become more or less levered because supply shocks to an industry which affect firm's equity base.

Table 1. Sample Description.

Leverage ratios and leverage determinants are described by their mean, and first, second and third quartiles.

Variable	*Mean*	*First Quartile*	*Median*	*Third Quartile*
(a) Measures of leverage				
Long-term debt/assets	0.25	0.08	0.20	0.35
Short-term debt/assets	0.10	0.01	0.05	0.13
Convertible debt/assets	0.02	0.00	0.00	0.00
(b) Measures of industry structure (N=199)				
Four-firm concentration ratio	0.29	0.18	0.25	0.36
Log of number of firms in industry	5.07	4.48	5.17	5.76
Median plant size in industry ($0000)	7.57	1.87	3.76	8.30
(c) Titman and Wessels variables (N=3914)				
Selling expenses/sales	0.34	0.20	0.30	0.45
R&D expenses/sales	0.03	0.00	0.00	0.02
Cash & marketable securities/assets	0.10	0.014	0.047	0.13
Operating income (EBITDA)/assets	-0.032	-0.036	0.026	0.067
Depreciation/total assets	0.049	0.027	0.041	0.061
Non-debt tax shields/total assets	0.029	0.00	0.00	0.014
Log of sales	4.55	2.88	4.55	6.22
Plant, equipment & inventory/assets	0.53	0.38	0.54	0.68
Capital expenditures/assets	0.085	0.026	0.056	0.10
Asset growth rate	1.52	-0.12	0.25	0.83
Intangibles/assets	0.05	0.00	0.00	0.05
Standard deviation of operating income	3.31	0.48	1.43	3.25

Table 2. Median leverage ratios in industries with highest and lowest concentration

Industry	*3-digit SIC code*	*Long-term debt/assets*	*Short-term debt/assets*	*Four-firm concentration*	*Log of firms*	*Median plant size*
(a) Industries with highest concentration						
Communications services nec	489	0.27	0.03	0.94	1.79	9.86
Tobacco	211	0.21	0.06	0.93	1.79	62.39
Federal credit agencies	611	0.52	0.42	0.89	1.61	165.71
Greeting cards	277	0.17	0.04	0.73	3.22	4.41
Motorcycles	375	0.20	0.07	0.71	2.71	6.06
Department stores	533	0.21	0.04	0.71	4.39	1.3
Motion picture distribution	782	0.23	0.01	0.69	2.56	21.93
Title insurers	636	0.10	0.04	0.68	3.26	4.4
Tire manufacturers	301	0.13	0.05	0.67	3.26	15.41
Cinemas	783	0.51	0.06	0.66	3.37	3.5
Photographic equipment	386	0.15	0.12	0.63	4.48	13.04
Motor vehicle manufacturers	371	0.21	0.05	0.62	6.25	23.58
(b) Industries with lowest concentration						
Fabricated rubber products nec	306	0.15	0.14	0.10	5.62	1.66
Home furnishing shops	571	0.19	0.07	0.09	5.43	1.23
Industrial equipment wholesale	508	0.09	0.31	0.09	6.65	2.29
Nursing homes	805	0.48	0.02	0.09	7.81	0.05
Metal work	344	0.18	0.04	0.09	6.9	2.09
Hospitals	806	0.41	0.03	0.08	8.21	3.49
Non-durables wholesale	519	0.24	0.04	0.08	6.01	5.11
Women's outerwear	233	0.22	0.06	0.08	6.44	0.74
Fabricated metal products	349	0.26	0.06	0.08	6.52	2.81
Machine tools	354	0.21	0.09	0.08	6.59	0.85
Building contractors	154	0.24	0.03	0.07	6.3	4.37
Plastic products	308	0.23	0.04	0.06	7.14	1.66

Table 3. Baseline inter-industry leverage regressions (industry-level)

OLS regressions predicting median debt/assets at the 3-digit SIC level for 199 industries. Regressors are industry medians of variables used in Titman and Wessels (1988).

	Long term debt/assets		*Short term debt/assets*		*Convertible debt/assets*	
	Coefficient	*t*	*Coefficient*	*t*	*Coefficient*	*t*
Intercept	0.109	2.07**	0.155	4.43***	0.044	0.55
Equipment industry dummy	-0.038	2.10**	0.004	0.34	-0.011	-0.43
Selling expenses/sales	0.122	2.01**	0.031	0.76	0.112	1.22
R&D expenses/sales	-1.245	2.55**	0.335	1.03	-0.081	-0.11
Cash/assets	-0.351	2.68***	-0.241	2.75***	0.417	1.88
Operating income/assets	-0.334	1.65*	-0.357	2.64***	-0.142	-0.47
Depreciation/assets	-0.078	0.18	-0.562	2.04**	0.378	0.61
Non-debt tax shields/assets	-1.364	2.69***	-0.075	0.22	0.853	0.85
Log of sales	0.0077	1.29	-0.0030	0.75	-0.0093	-1.07
Plant & property/assets	0.160	3.39***	-0.082	2.60***	0.106	1.57
Investment/assets	0.033	0.16	0.086	0.62	-0.116	-0.38
Asset growth	0.019	0.85	-0.0029	0.19	0.025	0.58
Standard deviation of income	8.3E-4	0.19	-0.0025	0.85	-0.009	0.95
Adjusted R^2		0.27		0.09		0.02

*** Coefficient is significant at the 1% level.
** Coefficient is significant at the 5% level.
* Coefficient is significant at the 10% level.

Table 4. Inter-industry regressions with strategic factors

OLS regressions predicting median debt/assets at the 3-digit SIC level for 199 industries. Regressors are industry medians.

	Long term debt/assets		*Short term debt/assets*		*Convertible debt/assets*	
	Coefficient	*t*	*Coefficient*	*t*	*Coefficient*	*t*
(a) Variables used in Titman and Wessels (1988)						
Intercept	0.033	0.37	0.204	3.49***	0.156	1.10
Equipment industry dummy	-0.037	2.03**	0.0040	0.33	-0.0087	0.32
Selling expenses/sales	0.136	2.14**	0.035	0.83	0.088	0.89
R&D expenses/sales	-1.368	2.74***	-0.213	0.64	0.030	0.04
Cash/assets	-0.342	2.60***	-0.245	2.81***	0.357	1.55
Operating income/assets	-0.329	1.62*	-0.366	2.72***	-0.139	0.45
Depreciation/assets	-0.096	0.23	-0.520	1.86*	0.543	0.85
Non-debt tax shields/assets	-1.277	2.46**	-0.080	0.23	0.872	0.85
Log of sales	0.0088	1.36	-0.0022	0.52	-0.0077	0.81
Plant & property/assets	0.158	3.31***	-0.084	2.67**	0.098	1.43
Investment/assets	0.074	0.35	0.082	0.58	-0.138	0.44
Asset growth	0.016	0.70	-2.3E-4	0.01	0.028	0.64
Standard deviation of income	0.0022	0.48	-0.0034	1.15	-0.0091	0.85
(b) Variables which identify the potential for strategic product market interaction						
Low entry dummy	-0.011	0.79	0.022	2.37**	-0.024	1.18
Four-firm concentration ratio	0.034	0.48	-0.065	1.39	-0.076	0.75
Number of firms in industry	0.011	1.06	-0.0085	1.19	-0.015	0.93
Minimum efficient scale	-6.6E-5	0.09	9.0E-6	0.01	-4.5E-4	0.47
F-test of the joint significance of product market interaction variables		0.58		1.99*		0.55
Adjusted R^2		0.26		0.11		0.01
Increment in R^2 over the baseline model (Table 3)		-1%		+2%		-1%

*** Coefficient is significant at the 1% level.
** Coefficient is significant at the 5% level.
* Coefficient is significant at the 10% level.

Table 5. Inter-industry regressions using orthogonalized traditional factors and strategic variables

OLS regressions predicting median debt/assets at the 3-digit SIC level for 199 industries. The first set of regressors industry medians are the first six principal components extracted from the Titman and Wessels (1988) variables. The second set of regressors consists of proxies for product market interaction potential.

	Long-term debt/assets		*Short-term debt/assets*		*Convertible debt/assets*					
	Coefficient	*t*	*Coefficient*	*t*	*Coefficient*	*t*	*Coefficient*	*t*	*Coefficient*	*t*	*Coefficient*	*t*
(a) Factors based on variables used in Titman & Wessels (1988)												
Intercept	0.225	34.1***	0.191	2.62**	0.061	13.7***	0.122	2.52**	0.109	11.3***	0.235	2.23**
Factor 1	-0.013	1.92*	-0.013	1.87*	0.0069	1.57	0.0065	1.45	0.021	2.03**	0.018	1.64*
Factor 2	0.036	5.42***	0.036	5.03***	-0.0081	1.84*	-0.0082	1.74*	0.0087	0.93	0.011	1.07
Factor 3	-0.029	4.36***	-0.029	4.27***	-0.0073	1.65*	-0.0068	1.53	0.021	1.77*	0.019	1.56
Factor 4	-0.020	3.08***	-0.022	3.15***	-0.0055	1.25	-0.0033	0.73	5.0E-4	0.05	0.0029	0.28
Factor 5	-0.017	2.57**	-0.016	2.30**	-0.010	2.27**	-0.012	2.58***	7.8E-4	0.05	0.0026	0.18
Factor 6	-0.0012	0.17	-0.0014	0.20	-0.0020	0.47	-0.0012	0.28	-1.8E-4	0.01	0.0021	0.20
(b) Variables which identify the potential for product market interaction												
Low entry dummy			-0.014	1.01			0.021	2.20**			-0.030	1.48
Four-firm concentration ratio			0.032	0.45			-0.060	1.30			-0.090	0.91
Number of firms in industry			0.0061	0.56			-0.010	1.41			-0.016	1.03
Minimum efficient scale			-2.2E-4	0.31			-8.8E-6	0.01			-7.3E-4	0.78
F-test of the joint significance of product market interaction variables				0.46				1.82				0.86
Adjusted R^2		0.24		0.23		0.05		0.06		0.03		0.02

*** Coefficient is significant at the 1% level.
** Coefficient is significant at the 5% level.
* Coefficient is significant at the 10% level.

Table 6. Inter-industry regressions with incremental coefficients for concentrated industries

OLS regressions predicting median debt/assets at the 3-digit SIC level for 199 industries. Regressors are industry medians. The incremental estimates for concentrated industries are estimated as the variable shown multiplied by a dummy variable which denotes industries with a four-firm concentration ratio in excess of 50% where no firm has a market share exceeding 70%.

	Long term debt/assets		*Short term debt/assets*		*Convertible debt/assets*	
	Coefficient	*t*	*Coefficient*	*t*	*Coefficient*	*t*
(a) Baseline Estimates						
Intercept	0.087	1.54	0.150	4.15***	0.026	0.30
Equipment industries dummy	-0.031	1.66*	0.0055	0.45	-0.002	0.09
Selling expenses/sales	0.180	2.69***	-0.013	0.31	0.091	0.87
R&D expenses/sales	-1.514	2.95***	-0.203	0.62	-0.113	0.15
Cash/assets	-0.466	3.25***	-0.165	1.78*	0.440	1.76*
Operating income/assets	-0.565	2.26**	-0.304	1.88*	-0.337	0.89
Depreciation/assets	0.420	0.69	-0.979	2.51**	0.782	0.79
Non-debt tax shields/assets	-1.024	1.38	-0.095	0.20	0.172	0.09
Log of sales	0.0094	1.30	-0.0035	0.76	-0.002	0.21
Plant & property/assets	0.099	1.73*	0.012	0.33	0.056	0.67
Investment/assets	0.258	0.77	-0.434	2.03**	0.086	0.14
Asset growth	0.023	0.71	0.018	0.85	-0.001	0.03
Standard deviation of income	0.0072	0.96	-0.0001	0.04	-0.008	0.61
(b) Incremental estimates for concentrated industries						
Selling expenses/sales	-0.218	1.83*	0.130	1.70*	0.170	0.98
R&D expenses/sales	0.169	0.10	-0.073	0.07	-0.898	0.41
Cash/assets	0.487	1.46	0.015	0.07	-0.018	0.03
Operating income/assets	0.495	1.04	0.056	0.18	0.599	0.78
Depreciation/assets	-0.280	0.31	0.242	0.42	-0.742	0.54
Non-debt tax shields/assets	-0.532	0.51	-0.055	0.08	0.772	0.33
Log of sales	-4.5E-4	0.04	0.0039	0.60	-0.021	1.40
Plant & property/assets	0.118	1.28	-0.187	3.14***	0.133	0.99
Investment/assets	-0.240	0.56	0.782	2.84**	-0.235	0.34
Asset growth	-0.023	0.47	-0.031	1.00	0.055	0.50
Standard deviation of income	-0.010	1.02	-0.0026	0.43	-5.6E-5	0.01
Adjusted R^2	0.28		0.16		-0.01	
Increment in R^2 over baseline	+1%		+7%		-3%	

*** Coefficient is significant at the 1% level.
** Coefficient is significant at the 5% level.
* Coefficient is significant at the 10% level.

Table 7. Baseline intra-industry leverage regressions (firm-level)

OLS regressions predicting intra-industry leverage ratios with assets measured at book for 3,369 firms in 1989. All variables represent deviations from 3-digit SIC industry medians. The regressors are those used in Titman and Wessels (1988).

	Long term debt/assets		*Short term debt/assets*		*Convertible debt/assets*	
	Coefficient	*t*	*Coefficient*	*t*	*Coefficient*	*t*
Intercept	0.043	9.40***	0.049	15.48***	0.019	2.45**
Dummy for equipment industries	0.012	1.64*	0.0038	0.77	0.015	1.41
Selling expenses/sales	0.029	1.99**	-0.020	1.97**	0.015	0.53
R&D expenses/sales	-0.086	1.31	-0.149	3.30***	-0.097	0.96
Cash/assets	-0.204	5.93***	-0.236	9.94***	0.221	4.55***
Operating income/assets	-0.224	7.30***	-0.344	16.26***	-0.084	1.93
Depreciation/assets	0.029	0.26	-0.144	1.90*	0.371	2.49**
Non-debt tax shields/assets	-0.322	6.72***	0.049	1.47	-0.132	1.12
Log of sales	0.0088	4.77***	-0.0072	5.62***	-0.013	4.82***
Plant & property/assets	0.0041	0.17	6.4E-4	0.03	0.0064	0.18
Investment/assets	0.022	0.50	-0.104	3.42***	-0.093	1.14
Asset growth	0.0011	1.58	3.4E-4	0.67	-7.9E-4	0.79
Intangibles/assets	0.472	4.18**	-0.014	0.17	-0.041	0.50
Standard deviation of income	0.0001	0.76	-1.3E-5	0.13	-3.8E-4	1.96**
Adjusted R^2		0.09		0.16		0.11

*** Coefficient is significant at the 1% level.
** Coefficient is significant at the 5% level.
* Coefficient is significant at the 10% level.

Table 8. Intra-industry regressions with incremental coefficients for concentrated industries

OLS regressions predicting intra-industry leverage ratios with assets measured at book value for 3,336 firms in 1989. All variables represent deviations from 3-digit SIC industry medians. The incremental estimates for concentrated industries are estimated as the variable shown multiplied by a dummy variable which denotes industries with a four-firm concentration ratio in excess of 50% where no firm has a market share exceeding 70%.

	Long term debt/assets		*Short term debt/assets*		*Convertible debt/assets*	
	Coefficient	*t*	*Coefficient*	*t*	*Coefficient*	*t*
Intercept	0.042	9.09***	0.049	15.49***	0.017	2.19**
Dummy for equipment industries	0.014	1.94*	0.0035	0.70	0.013	1.23
Selling expenses/sales	0.0064	0.41	-0.0073	0.68	-0.028	0.85
R&D expenses/sales	-0.034	0.51	-0.153	3.34***	-0.059	0.57
Cash/assets	-0.230	6.20***	-0.235	9.17***	0.250	4.78***
Operating income/assets	-0.233	7.19***	-0.320	14.22***	-0.097	2.11**
Depreciation/assets	0.179	1.34	-0.128	1.38	0.546	3.06***
Non-debt tax shields/assets	-0.318	6.33***	0.047	1.34	-0.094	0.65
Log of sales	0.011	5.44***	-0.0089	6.17***	-0.012	4.03***
Plant & property/assets	-0.016	0.58	0.013	0.67	-0.0096	0.24
Investment/assets	0.0035	0.07	-0.124	3.54***	-0.059	0.64
Asset growth	0.0009	1.24	3.7E-4	0.69	-0.0010	0.99
Intangibles/assets	0.555	4.49***	-0.076	0.88	-0.059	0.66
(b) Incremental estimates for concentrated industries.						
Standard deviation of income	7.3E-5	0.48	-2.3E-5	0.22	-4.6E-4	2.25**
Selling expenses/sales	0.192	4.21***	-0.099	3.13***	0.135	1.96**
R&D expenses/sales	-1.866	3.96***	0.043	0.13	0.850	0.96
Cash/assets	0.240	2.53**	-0.016	0.24	-0.135	0.99
Operating income/assets	0.093	1.04	-0.193	3.13***	-0.070	0.48
Depreciation/assets	-0.524	2.18**	-0.100	0.60	-0.687	1.94*
Non-debt tax shields/assets	-0.104	0.73	0.058	0.58	0.229	0.84
Log of sales	-0.0055	1.24	0.0071	2.31**	-0.0065	0.88
Plant & property/assets	0.086	1.43	-0.042	1.01	0.124	1.22
Investment/assets	0.087	0.86	0.083	1.19	-0.092	0.43
Asset growth	0.0030	1.16	-3.4E-4	0.19	0.0042	0.48
Intangibles/assets	-0.563	1.91*	0.354	1.73*	0.169	0.76
Standard deviation of income	0.0003	0.71	6.9E-5	0.23	3.2E-4	0.50
Adjusted R^2		0.10		0.16		0.11
Increment in R^2 over baseline model (Table 7)		+1%		0%		0%

*** Coefficient is significant at the 1% level.
** Coefficient is significant at the 5% level.
* Coefficient is significant at the 10% level.

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